Great Lakes Forest Products Limited,
Thunder Bay, Ontario . . .

GREAT LAKES FOREST PRODUCTS LIMITED

THUNDER BAY, ONTARIO

REPORT OF

PROVINCIAL OFFICER

PURSUANT TO

THE ENVIRONMENTAL PROTECTION ACT, 1971

SECTION 83

FILED BY P. KHARE, P. ENG.

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1. INTRODUCTION

1.1 BACKGROUND

Great Lakes Forest Products Limited, owned by CP Investments, operates an industrial complex located on the north bank of the Kaministiquia River in the City of Thunder Bay. The complex, which covers approximately 300 acres of land, consists of two kraft (A and B) pulp mills, a newsprint mill, a waferboard manufacturing plant, a chemical plant and a stud mill. Approximately 3,830 people are employed at the complex and its woodlands division.

The mill was started in 1923 as a groundwood pulp mill and was expanded over the years to the present complex designed to produce 415,000 tons per year newsprint, 450,000 tons per year kraft pulp, 100,000,000 board feet per year of stud lumber and 96,000,000 square feet of 3/8-inch waferboard.

1.2 DEVELOPMENT OF THE EFFLUENT TREATMENT SYSTEM

Prior to 1967, the effluent from the industrial complex was diverted directly into the Kaministiquia River without any treatment. The effluent was very high in biochemical oxygen demand (BOD) and suspended solids. With the completion of the 600 tons per day kraft mill in 1967 ("A" kraft mill), the company installed clarifiers to provide primary treatment for the kraft mill effluent. The second major phase of primary treatment was accomplished in 1971 when two additional clarifiers were installed to treat the newsmill effluent, with a fluidized bed incinerator to burn the resultant sludge.

These improvements resulted in substantial reductions in the suspended solids discharged in the final effluent. The reductions are reflected in the quarterly report submitted by the company to the Ministry of the Environment (since 1978, these reports have been submitted on a monthly basis). A graph showing these reductions has been included in Appendix A.

Further improvements in effluent BOD and suspended solids were realized in 1972, when the woodroom was converted to dry debarking operations and a clarifier was installed to reduce the bark fines, gravel, sand, etc., being discharged from the woodroom and associated areas.

In the second quarter of 1975, the sulphite pulping process, a part of the newsprint mill operating on a low-yield magnesium-based process, was converted to a high-yield magnesium-based process, resulting in further reductions to the BOD levels in the newsmill effluent. In 1976, the sulphite pulping was converted to a high-yield sodium-based process with no major environmental changes.

In 1973, the company announced its plan to build a new kraft mill. This kraft mill, known as the "B" mill, was completed in late 1976 and it incorporated the new closed-cycle process proposed by Drs. H. Rapson and D. Reeve (also called the Rapson-Reeve process). Initially, the company achieved considerable success with the closed-cycle process and being encouraged by the fact that apparently only minor problems remained, the company committed itself to converting the "A" kraft mill to the same process. However, Great Lakes has now informed the Ministry that regrettably it cannot at this time foresee when development work would be sufficiently complete to reschedule with confidence the design and installation of a closed-cycle water system in "A" mill. The company can see no feasible alternative to meeting the Ministry of the Environment objectives for BOD discharged from "A" kraft mill except to design a new secondary treatment system capable of reducing at least 70% of the BOD.

Studies on how to achieve this alternative have already been undertaken but the installation and operation of such a system cannot be achieved until December, 1983.

1.3 AIR ABATEMENT EQUIPMENT

In the two kraft mills, air abatement equipment installed is: a weak black liquor (WBL) oxidation system installed with the building of the "A" kraft mill in 1967; a strong black liquor (SBL) oxidation system installed later; the WBL and SBL oxidation systems were also installed in "B" kraft mill when it was built in late 1976.

Each of the recovery boilers in the two kraft mills are equipped with electrostatic precipitators to trap the suspended particulates from being emitted to the environment. The air emissions from the two lime kilns are passed through wet scrubbers to trap particulate matter from the exhaust gases.

The smelt dissolving tank vent gases are mixed with the recovery furnace flue gases and passed through the electrostatic precipitators and direct contact evaporators to reduce total suspended particulate emissions.

In the newsmill, an acid tower was installed to reduce SO_2 emissions. Other air abatement devices in the industrial complex include cyclones and scrubbers in various sections.

2. WATER ASSESSMENT

2.1 WASTEWATER TREATMENT SYSTEM

The present wastewater treatment system at Great Lakes Forest Products Limited is shown in Figure 1. The wastewater streams from different sections of the industrial complex join at various stages and are treated by a clarifier system before combining into two final outfalls that enter into the Kaministiquia River at the Westfort turning basin (Figure 2).

2.1.1 Clean Water Outfall

The clean water outfall is essentially made up of the following relatively clean water streams from various discharge points in the industrial complex (Figure 1).

- "B" digester, "B" recausticizing, "B" lime kiln
- SRP condenser water
- chemical plant
- roof drains, some yard drainage
- waferboard plant
- salt recovery process (SRP)
- floor drains (when contaminated, these drains are not discharged to the clean water outfall)

The discharge point of the outfall is shown in Figure 2. The effluent characteristics and the flows from the clean water outfall will be discussed later in this report.

2.1.2 Final (Submerged Diffuser) Outfall

The final outfall is made up of the following major wastewater streams discharged from different sections of the industrial complex (Figure 1):

- news discharge clarifier overflow (including woodroom effluent)
- kraft neutral fibre clarifier overflow
- blending tank discharge (acid and alkaline sewers from kraft mill)
- kraft mill water treatment plant (graver) sludge

The point of discharge of the final outfall is shown in Figure 2. The wastewater characteristics of the outfall will be discussed later in this report.

2.2 COLLECTION OF DATA

2.2.1 Wastewater Survey (1978)

Eight locations in the wastewater system were sampled for nine separate days during the wastewater survey. The sampling dates were May 30 and 31, June 1, 20, 21, 22, 27, 28 and 29, 1978. These dates have been referred to as sampling day one through to sampling day nine. The samples were composited by taking one-litre samples approximately every 25 minutes for six hours.

A total of eight locations in the various sections of the mill were sampled throughout. The locations were carefully selected in consultation with the appropriate mill personnel taking the following factors into consideration: accessibility to the location; availability of the flow measuring device at the location; importance of the location with respect to isolating a section of the mill; reliability of the sample at the location (complete mixing and no hydraulic constraints).

The mill operations were reasonably normal on these dates except for May 31 and June 1 when the salt recovery plant in the "B" kraft mill had to be shut down due to technical problems and the "B" kraft mill was running in the conventional mode without any bleachery recycle.

The sampling locations are as follows:

(i) Clean Water Outfall

Essentially clean water from various sections of the mill being discharged to the Kaministiquia River (see Section 2.1.1 "Clean Water Outfall").

(ii) Combined Water Outfall

Contaminated effluent streams from various sections of the mill complex are combined to be discharged to the Kaministiquia River through this outfall (see Section 2.1.2 "Final (Submerged Diffuser) Outfall").

(iii) Neutral Fibre Clarifier (in)

Combination of different fibre-containing streams of wastewater from the two kraft mills prior to clarification.

(iv) News Clarifier (in)

Combination of all the wastewater streams from the newsmill, some drainage and the woodroom clarifier overflow. Woodroom clarifier treats the deicing deck wastewater and the #6 boiler ash sluice water.

(v) Neutral Fibre Clarifier (out)

The overflow from the neutral fibre clarifier.

(vi) Blending Tank (out)

The blending tank combines the acid sewer (essentially consisting of all acidic streams) and the alkaline sewer (consisting of all the major alkaline streams) from the "A" kraft mill. After pH adjustment, the blending tank overflow is discharged to the combined outfall.

(vii) News Clarifier (out)

The overflow from the news clarifier.

(viii) "B" Kraft Mill Neutral Fibre

Combination of most of the contaminated wastewater streams from "B" kraft mill. In a designed closed-cycle mode of operation, this stream would be minimal with small loadings.

All the samples collected at various locations were analysed at the Ministry of the Environment laboratory in Thunder Bay for pH, BOD, suspended solids, dissolved solids, total phosphorus, sulphates, phenols and volatile suspended solids. The data has been tabulated in Appendix B.

2.2.2 Company Supplied Data

The company, in accordance with a Ministry of the Environment requirement, has been supplying effluent loading information since 1968. The information has been supplied in the form of quarterly reports until March, 1978 and monthly thereafter.

The BOD, suspended solids and the dissolved solids parameters from the company-supplied information have been plotted in Appendix A.

2.2.3 Miscellaneous Data

The Ministry of the Environment collects regular water samples from the Kaministiquia River as a part of the water quality study in the Thunder Bay area. These results have been summarized in Appendix C. The Industrial Abatement Section also collects effluent samples at the mill to audit the company-supplied information.

2.3 EFFLUENT REQUIREMENTS

The booklet "Water Management-Goals, Policies, Objectives and Implementation Procedures," published by the Ministry of the Environment in November, 1978, provides the following approach to establishing the effluent requirements.

(i) Effluent requirements based upon the waste assimilative capacity of the receiving water will be established.

(ii) The above-determined effluent requirements will be compared to the Federal or Provincial effluent requirements or guidelines.

(iii) The most stringent effluent requirement established of the above will be imposed.

In the particular case of Great Lakes Forest Products Limited, only the effluent requirements with respect to BOD, suspended solids and toxicity will be considered.

2.3.1 Biochemical Oxygen Demand (BOD)

A regional water quality survey report published by the Ministry of the Environment in 1972 estimated the assimilative capacity of the Kaministiquia River with respect to BOD. Figure 3 has been reprinted from the report to illustrate the BOD assimilative capacity at different river flows for desired dissolved oxygen levels.

The minimum flow in the Kaministiquia River, as a result of an agreement between the Ministry of the Environment and Ontario Hydro, cannot be less than 11.35 m^3/sec. (400 cfs) in winter and 17 m^3/sec. (600 cfs) during summer. Since the assimilation study was carried out in summer, the minimum summer flows of 600 cfs to the Kaministiquia River are considered for enforcement purposes. Using 5 mg/l as a desired dissolved oxygen level in the river, the assimilative capacity of the Kaministiquia River is determined from Figure 3 to be 20,000 lbs/day (9.07 metric tons/day BOD).

The BOD discharge permitted as per the Federal guidelines from the industrial complex based upon 1978 average production rate is 92.7 metric tons per day. The details of the calculation for allowable BOD discharged are shown in Appendix D.

Considering the most stringent requirement, Great Lakes Forest Products Limited is permitted to discharge 9.0 metric tons/day (20,000 lbs/day) of BOD, based on 1970 average data.

2.3.2 Suspended Solids

The Ontario Ministry of the Environment guidelines specify a maximum discharge of 50 mg/l of suspended solids in the pulp and paper mill effluent. Based upon an efficient water usage of 30,000 Imperial gallons per short ton for kraft pulp production and 15,000 Imperial gallons per short ton of newsprint production, the 50 mg/l translates into 14 metric tons per day of suspended solids discharged using maximum production (see Appendix D).

The calculations for the suspended solids discharge permitted from Great Lakes Forest Products Limited, based upon Federal Department of Environment guidelines for pulp and paper effluent have been shown in Appendix D. These calculations show that the industrial complex is permitted to discharge 31.0 metric tons of suspended solids per day.

The effluent requirement for suspended solids, based upon assimilative capacity of the Kaministiquia River, has not been calculated because of a present lack of data. It is expected to be higher than the Provincial guidelines.

Considering the most stringent requirements, Great Lakes Forest Products Limited is permitted to discharge 14 metric tons/day of suspended solids, based on 1978 average data.

2.3.3 Toxicity

The Federal pulp and paper effluent regulations require that a minimum of 80% of the fish survive in a 65% effluent/35% water mixture when subjected to the standard 96-hour static bioassay test, i.e. LC_{80} = 65%. The Provincial guidelines specify that a minimum of 50% of the fish survive in 100% effluent concentration when subjected to the standard 96-hour bioassay test, i.e. LC_{50} = 100%.

2.4 DISCUSSION OF DATA

It should be borne in mind that during the wastewater survey, the Rapson-Reeve closed-cycle water system in "B" mill was in a developing stage. Company reports suggested that although substantial progress had been made toward closing the mill water use cycle, complete closure had not been achieved. Furthermore, due to the SRP plant being down, the "B" mill was running in open-cycle or conventional mode during the sampling of May 31 and June 1, 1978.

2.4.1 Suspended Solids

The total suspended solids discharged to the Kaministiquia River, as determined by the suspended solids data supplied by the company from 1968 to present, is shown in Appendix A.

The data indicates that the final effluent discharged from the industrial complex does not consistently meet the effluent requirements of 14 metric tons/day of suspended solids.

2.4.2 Biochemical Oxygen Demand (BOD)

The biochemical oxygen demand (BOD) discharged to the Kaministiquia River, as determined by the wastewater survey, has been shown in Figures 7, 8, 9 and 10 and the BOD data supplied by the company has been shown in Appendix A.

The data indicates that the effluent discharged from the industrial complex does not meet the effluent requirements of 20,000 lbs or 9.07 metric tons/day of BOD.

The data plotted in Figure 10 indicates that the newsmill effluent is a major contributor towards the final effluent BOD discharged to the Kaministiquia River. In general, the contribution of different sections of the mill to the final BOD discharge is as follows:

Newsmill - 55% to 75% (55-75 metric tons/day)

"A" Kraft Mill - 25% to 35% (25-35 metric tons/day)

"B" Kraft Mill - 3% to 8% (3-8 metric tons/day)

2.4.3 Toxicity

The data collected to date by the Ministry of the Environment shows that the final effluent discharged from the industrial complex does not meet the Federal or the Provincial toxicity requirements (Section 2.3.3).

3. AIR ASSESSMENT

The theoretical air emissions from different sources at Great Lakes Forest Products Limited has been attached as Table 1 to this report. This inventory was prepared in 1974-75 to check the air emissions from different sources in the industrial complex, based upon the design data submitted by the company along with the application for the approval of the "B" kraft mill construction. Thus, Table 1 represents theoretical emissions from the industrial complex and no actual emission data from the different sources, based upon source testing, have been made available to the Ministry.

A number of complaints of foul odours and particulate have been received by the Ministry from the residents in the vicinity of Great Lakes Forest Products Limited. The odours are generally caused by the presence of total reduced sulphur (TRS) compounds in the air. A listing of the complaints from the residents is attached to this report as Table 2.

The Thunder Bay Annual Air Quality Report published by the Ministry of the Environment, has identified the Great Lakes Forest Products Limited complex to be the

source of the TRS compounds. Upon examination of Table 1, it is evident that the recovery boiler stack, the weak black liquor oxidation vents and the lime kilns are the three major sources of TRS emissions from the industrial complex. However, no definite conclusions can be drawn until actual source tests for air emissions can be carried out.

The Thunder Bay Air Quality Reports, based upon the regular ambient air monitoring of TRS and the special surveys carried out by the Ministry of the Environment mobile monitoring unit have indicated that the TRS emissions from the industrial complex occasionally exceed the Ministry of the Environment guidelines.

The particulate emissions from the industrial complex could be identified to a number of sources such as the power boilers, the waferboard plant, and the lime kiln.

4. CONCLUSIONS

The following conclusions can be drawn from the report.

(1) The biochemical oxygen demand (BOD) in the final effluent discharged from the industrial complex into the Kaministiquia River is above the minimum BOD standards of 9.07 metric tons/day set by the Ministry of the Environment requirements (see Section 2.3 for details). The newsmill effluent contributes 55-75% of the total BOD discharged from the mill.

(2) The suspended solids in the final effluent discharge from the industrial complex into the Kaministiquia River do not consistently meet the minimum suspended solids standards of 14 metric tons/day set by the Ministry of the Environment's requirements (see Section 2.3 for details).

(3) The final effluent discharged from the industrial complex into the Kaministiquia River does not meet the Federal or the Provincial effluent toxicity requirements.

(4) The air emissions from the industrial complex create an ambient air problem in the vicinity of the complex. However, firm conclusions cannot be drawn until an emission source inventory based on stack emission measurements at the complex is prepared.

5. FINDINGS

(1) The information contained in this report prepared in accordance with Section 83 of The Environmental Protection Act, 1971, indicates that the suspended solids and the biochemical oxygen demanding (BOD) chemicals discharged by the Great Lakes Forest Products Limited industrial complex effluent cause, and are likely to continue to cause, impairment of the quality of the natural environment for any use that can be made of it, contrary to Section 14 1(a) of The Environmental Protection Act, 1971.

(2) The information contained in the Section 83 report indicates that the suspended solids and the biochemical oxygen demanding chemicals discharged by the said industrial complex in its effluent cause, and are likely to continue to cause injury or damage to the plant or animal life, contrary to Section 14 1(b) of The Environmental Protection Act, 1971.

(3) The information contained in the Section 83 report indicates that total suspended particulate and total reduced sulphur compounds (TRS) emitted by the said industrial complex cause, and are likely to continue to cause, harm or material discomfort to any person, contrary to Section 14 1(c) of The Environmental Protection Act, 1971.

6. RECOMMENDATIONS OF THE PROVINCIAL OFFICER

As a result of the foregoing conclusions and findings, it is recommended that the Director, Northwestern Region, issue a Control Order directing Great Lakes Forest Products Limited at its Thunder Bay industrial complex to:

1. (a) By December 31, 1980, submit to the Director, Northwestern Region, a written report on an inventory, based on the terms of reference to which the Director, Northwestern Region, has given his prior approval, on atmospheric emissions of total suspended particulate, total reduced sulphur compounds, sulphur dioxide and nitrogen oxide from the industrial complex.

(b) By June 30, 1981, provide the Director, Northwestern Region, with a written proposal outlining the plans required to reduce such emissions to meet Ontario Regulation 15, Section 5 of The Environmental Protection Act, 1971, if this is found to be necessary.

(c) By December 31, 1981, submit to the Director, Northwestern Region, an application pursuant to Section 8 of The Environmental Protection Act, 1971, for the approval of the system proposed in 1(b) above.

(d) By December 31, 1983, construct, install, and have in operation the system approved pursuant to 1(c) above.

2. (a) By December 31, 1980, submit an application pursuant to Section 42 of The Ontario Water Resources Act and Section 8 of The Environmental Protection Act, 1971, for the approval of a system for the recovery of chemicals from the spent bisulphite liquors (SBL) presently being discharged from the newsmill. The proposed system should be designed to collect not less than 90% of the SBL.

(b) By December 31, 1982, construct, install, and have in operation the system approved pursuant to 2(a) above.

(c) By December 31, 1983, submit to the Director, Northwestern Region, a report on a study carried out to evaluate the performance of the system installed pursuant to 2(b) above. The terms of reference of the study are to be agreed to by the Director, Northwestern Region.

3. (a) By September 30, 1980, submit to the Director, Northwestern Region, a proposal for a system designed to reduce the BOD in the effluent from "A" kraft mill equivalent to that achievable by secondary treatment and to ensure that the total BOD discharged in the effluent from the two kraft mills does not exceed twelve metric tons per day based on any thirty consecutive working day average.

(b) By December 31, 1981, submit to the Director, Northwestern Region, an Application for Approval of the system proposed pursuant to 3(a) above.

(c) By December 31, 1983, construct, install and have in operation the system approved pursuant to 3(b) above.

4. (a) By December 31, 1981, submit to the Director, Northwestern Region, a written report outlining a system designed to ensure that the net suspended solids in the total effluent discharged from the industrial complex will not exceed 50 milligrams per litre or, alternatively 14.0 metric tons per day based on any thirty consecutive working day average. In this case, suspended solids do not include biological solids generated in the aeration lagoon section of the secondary treatment system. The loading from this system may be calculated from flows and concentrations of samples obtained from either the influent or effluent end of the secondary treatment system.

(b) By December 31, 1982, submit an application pursuant to Section 42 of The Ontario Water Resources Act for the approval of the system described in the report submitted pursuant to 4(a) above.

(c) By December 31, 1983, construct, install, and have in operation the system approved pursuant to 4(b) above.

5. (a) By December 31, 1983, submit a proposal, the terms of reference of which are to be agreed to by the Director, Northwestern Region, and the company, on a study to evaluate the quality of the mill's effluent with respect to BOD, total suspended solids and toxicity.

(b) By September 30, 1984, have completed the study proposed in 5(a) above and submit to the Director, Northwestern Region, a report on the study.

6. By June 30, 1985, if the industrial complex is not in compliance with Provincial Water Quality Objectives, submit to the Director, Northwestern Region, an engineering feasibility study including estimated costs of all the alternatives considered for complying with the toxicity requirements of the pulp and paper effluent regulations made under The Fisheries Act, SOR/71-578, and for controlling BOD from the industrial complex in order to meet the Provincial Water Quality Objectives.

In exceptional cases, where it is clearly demonstrated that all reasonable and practical measures to attain the Provincial Water Quality Objectives have been undertaken but where:

(1) the Provincial Water Quality Objectives are not attainable because of natural background water quality;

(2) the Provincial Water Quality Objectives are not attainable because of irreversible man-induced conditions;

(3) to attain or maintain the Provincial Water Quality Objectives would result in substantial and widespread adverse economic and social impact;

(4) suitable treatment techniques are not available;

then the Director, Northwestern Region, with input from the public, will consider the proposed alternatives.

7. By December 31, 1980 and every three months thereafter report to the Director, Northwestern Region, in writing on the progress made in the previous three months towards achieving compliance with this Control Order.

8. Where approval is required under Section 8 of The Environmental Protection Act, 1971, and under Section 42 of The Ontario Water Resources Act, the Director, Northwestern Region, may require Great Lakes Forest Products Limited:

(a) To submit to the Director, Northwestern Region, a construction major equipment ordering and delivery schedule.

(b) To submit to the Director, Northwestern Region, progress reports on the construction and installation of the works concerned at such intervals as Great Lakes Forest Products Limited and the Director, Northwestern Region, agrees to or at such intervals as he may direct in writing if no agreement is made.

9. To maintain, keep in repair and operate the facilities to be constructed and installed pursuant to this Control Order, in particular the closed-cycle water system in "B" kraft mill and to work toward maximum closure of that system. Such maintenance, repair and operation shall be in accordance with any specific directions and recommendations which the Director, Northwestern Region, shall make from time to time.

10. In the event of Great Lakes Forest Products Limited being rendered unable to perform or comply with any obligations herein because of:

    (a) Acts of God.

    (b) Strikes, lockouts, or other industrial disturbances.

    (c) Inability to obtain materials or equipment for reasons beyond the control of Great Lakes Forest Products Limited.

    The obligation hereof as they are affected by (a), (b), or (c) above shall be adjusted in a manner acceptable to both the Director, Northwestern Region and to Great Lakes Forest Products Limited. To obtain such an agreement, Great Lakes Forest Products Limited must notify the Director, Northwestern Region, immediately of any of the above occurrences, providing details that prove no alternatives are feasible in order to meet the compliance dates in question.

REFERENCES

1. Thunder Bay Regional Water Quality Survey, September, 1972, Ministry of the Environment.

2. Air Quality Report, Thunder Bay, 1976, Ministry of the Environment.

3. Air Quality Report, Thunder Bay, 1977, Ministry of the Environment.

4. Air Quality Report, Thunder Bay, 1978, Ministry of the Environment.

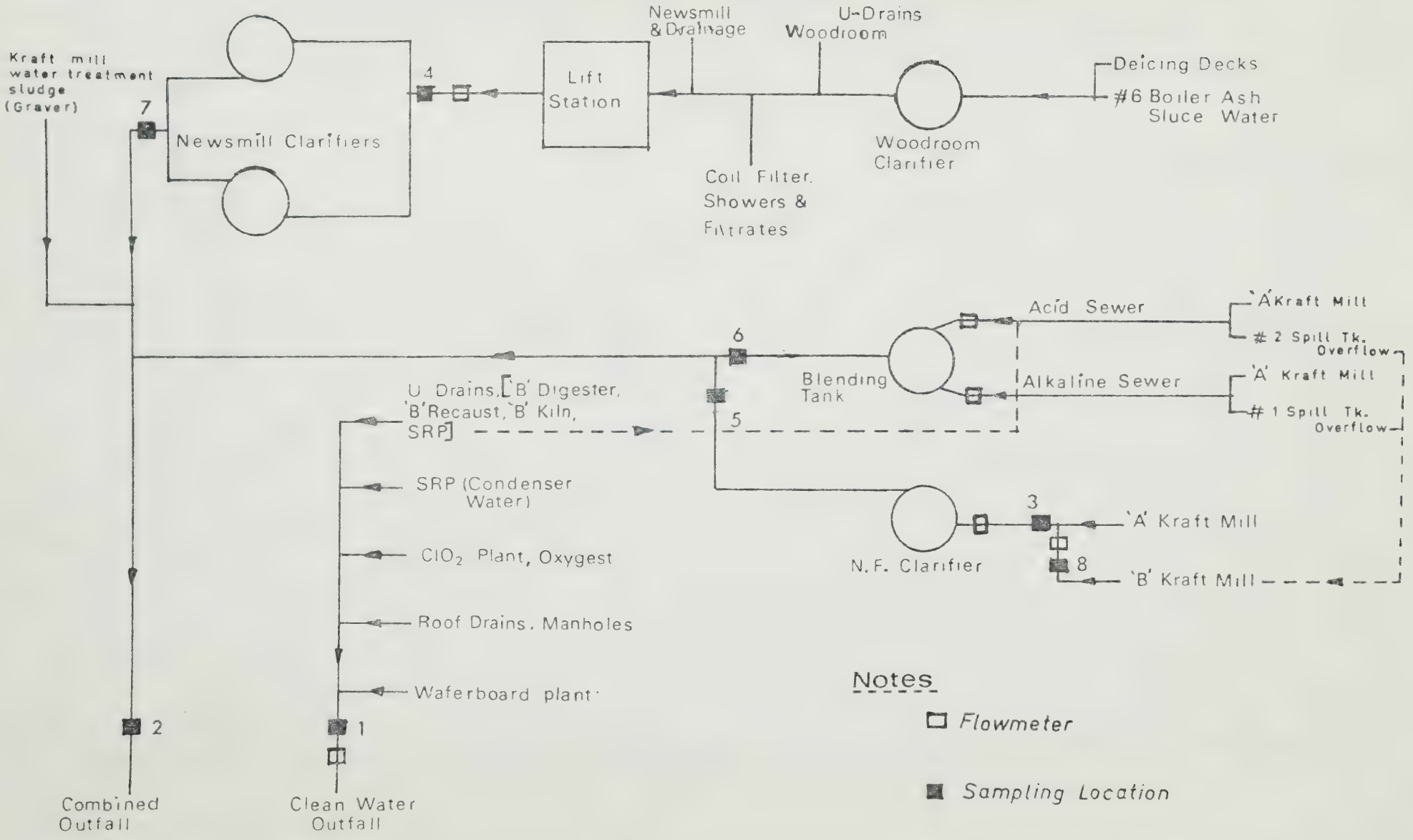
5. Water Management, Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment, November, 1978.

6. Pulp and Paper Effluent Regulations, Water Pollution Control Directorate, Environment Canada, November, 1971.

7. Sulphite Pulping Spent Liquor Recovery and Effluent Treatment, EPS 3-WP-72-2, Water Pollution Control Directorate, December, 1972.

Fig1. Effluent Treatment System

Great Lakes Forest Products Ltd.



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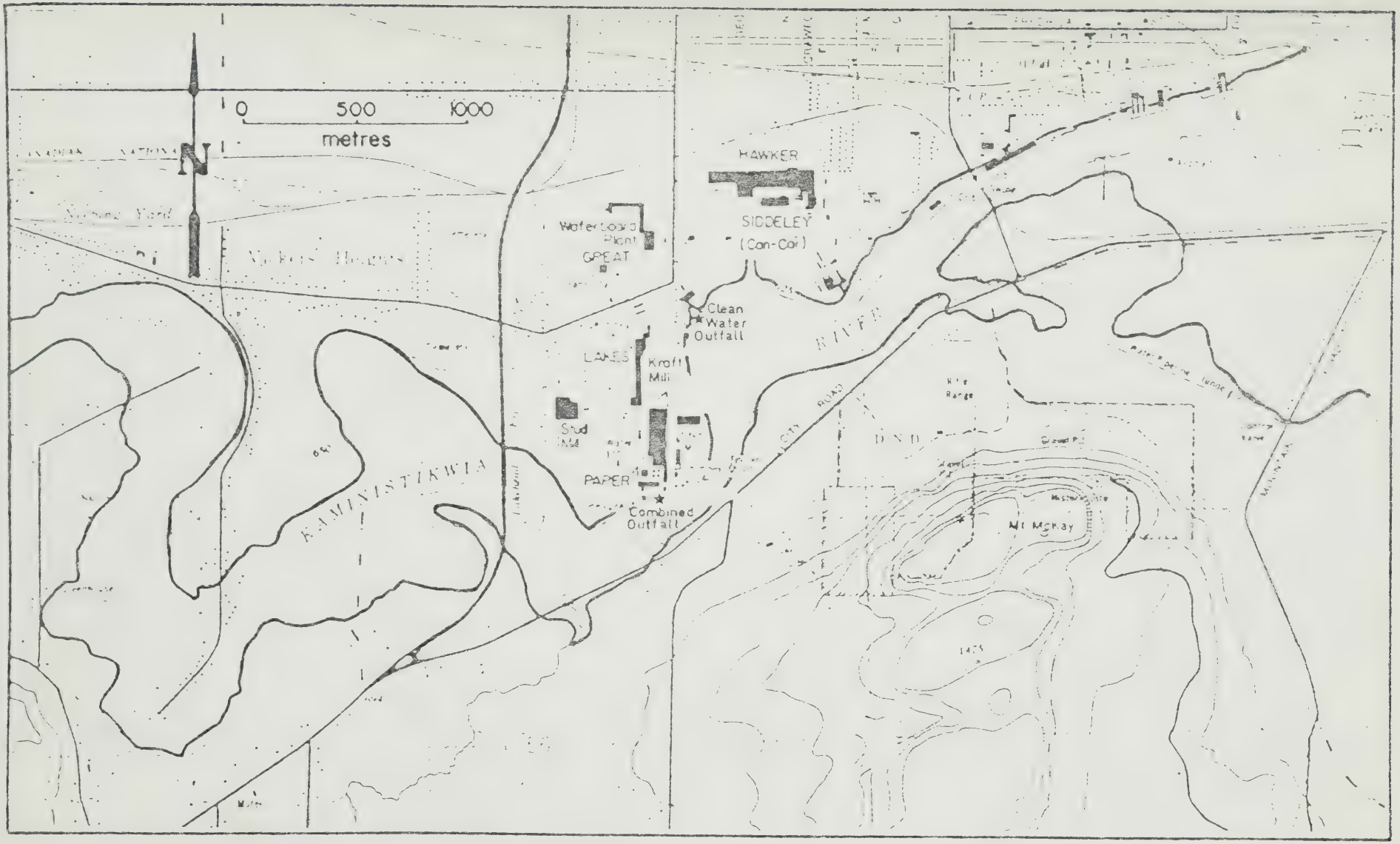


Fig. 2 Location of the two effluent discharges at GLFP Ltd.

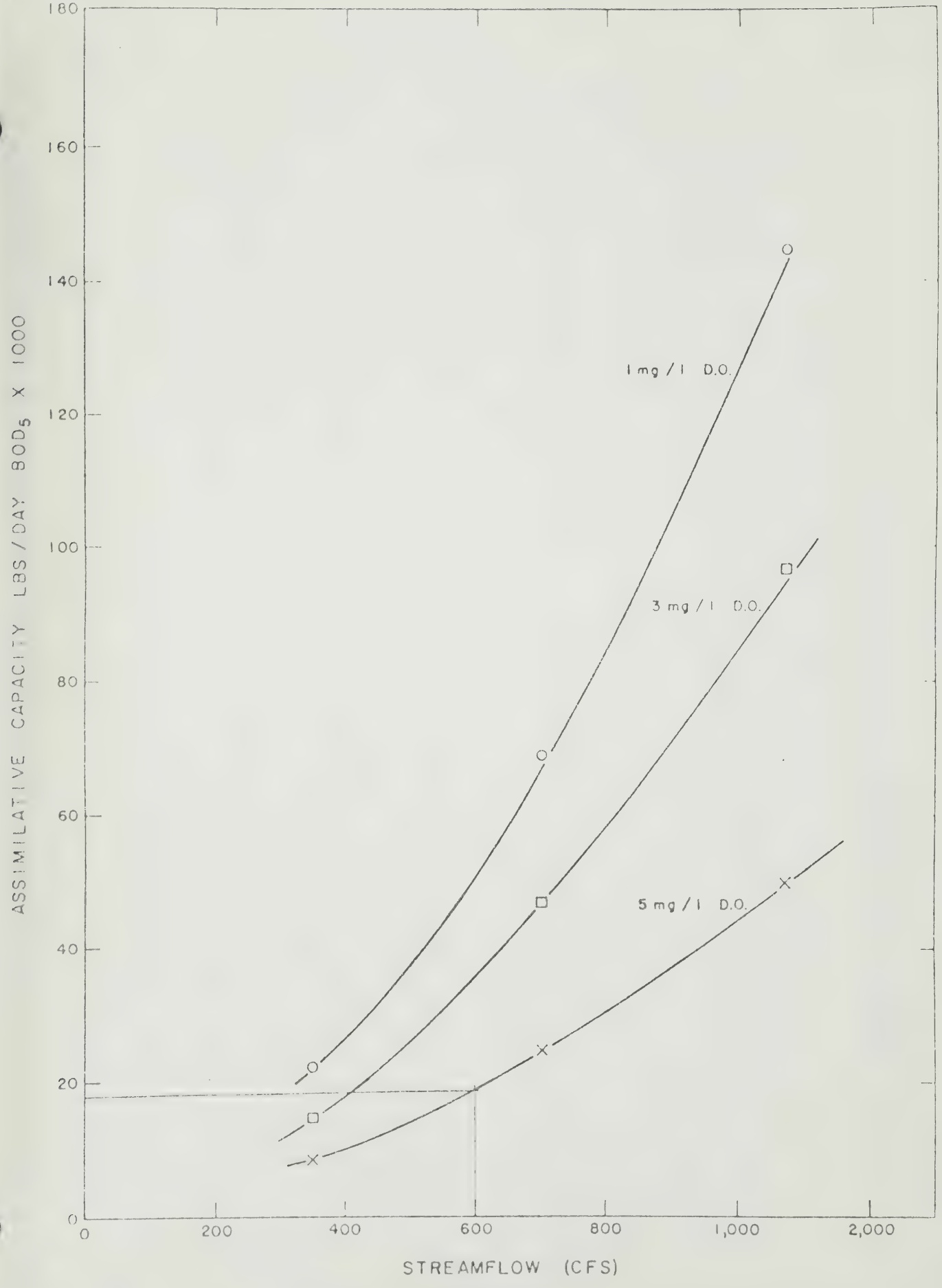


FIGURE 3. Assimilative capacity of the Kaministikwia River downstream from Westfort Turning Basin

Source: Reference #1

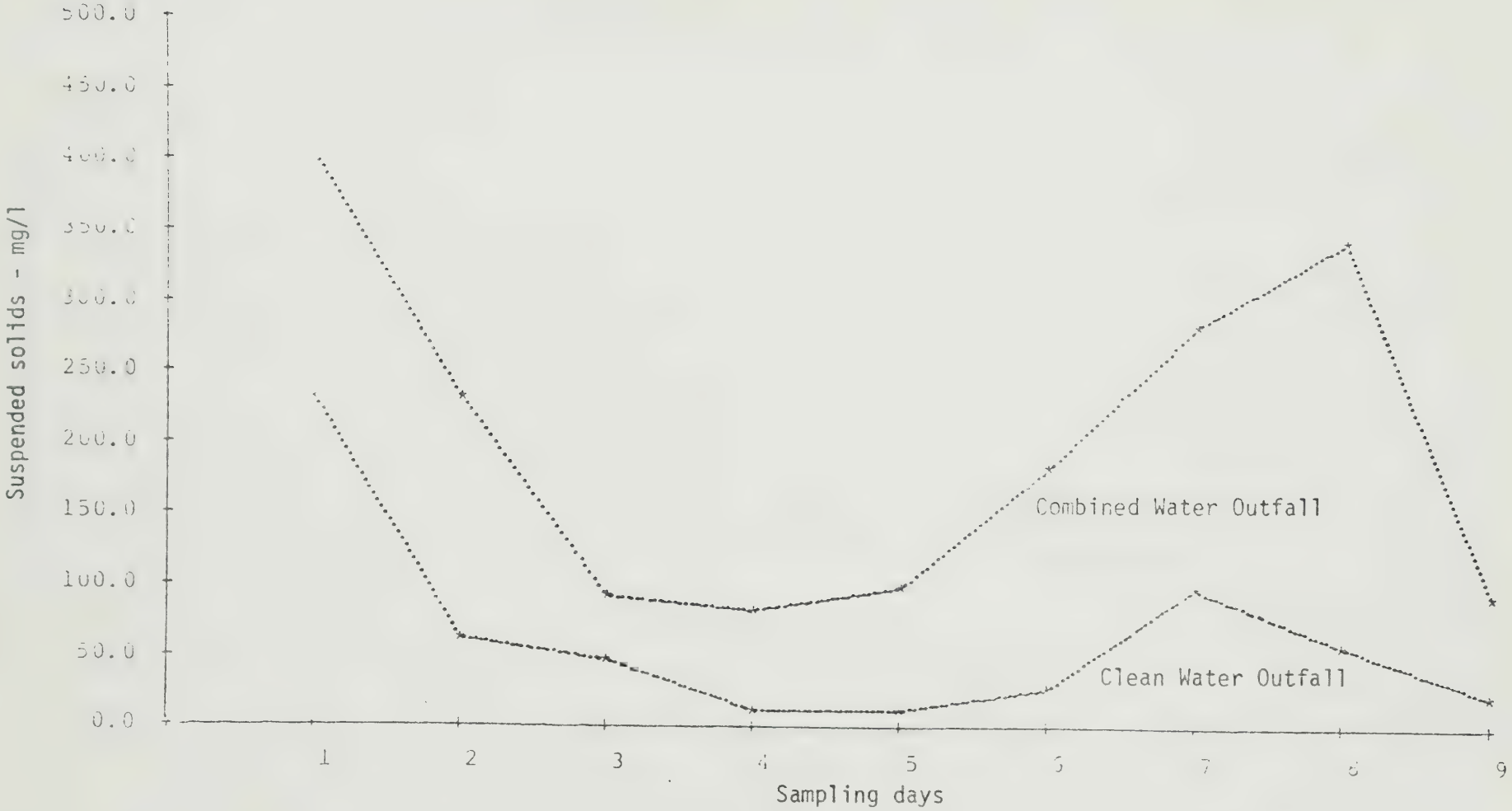


FIGURE 4. Suspended solids discharged to the Kaministiquia River.

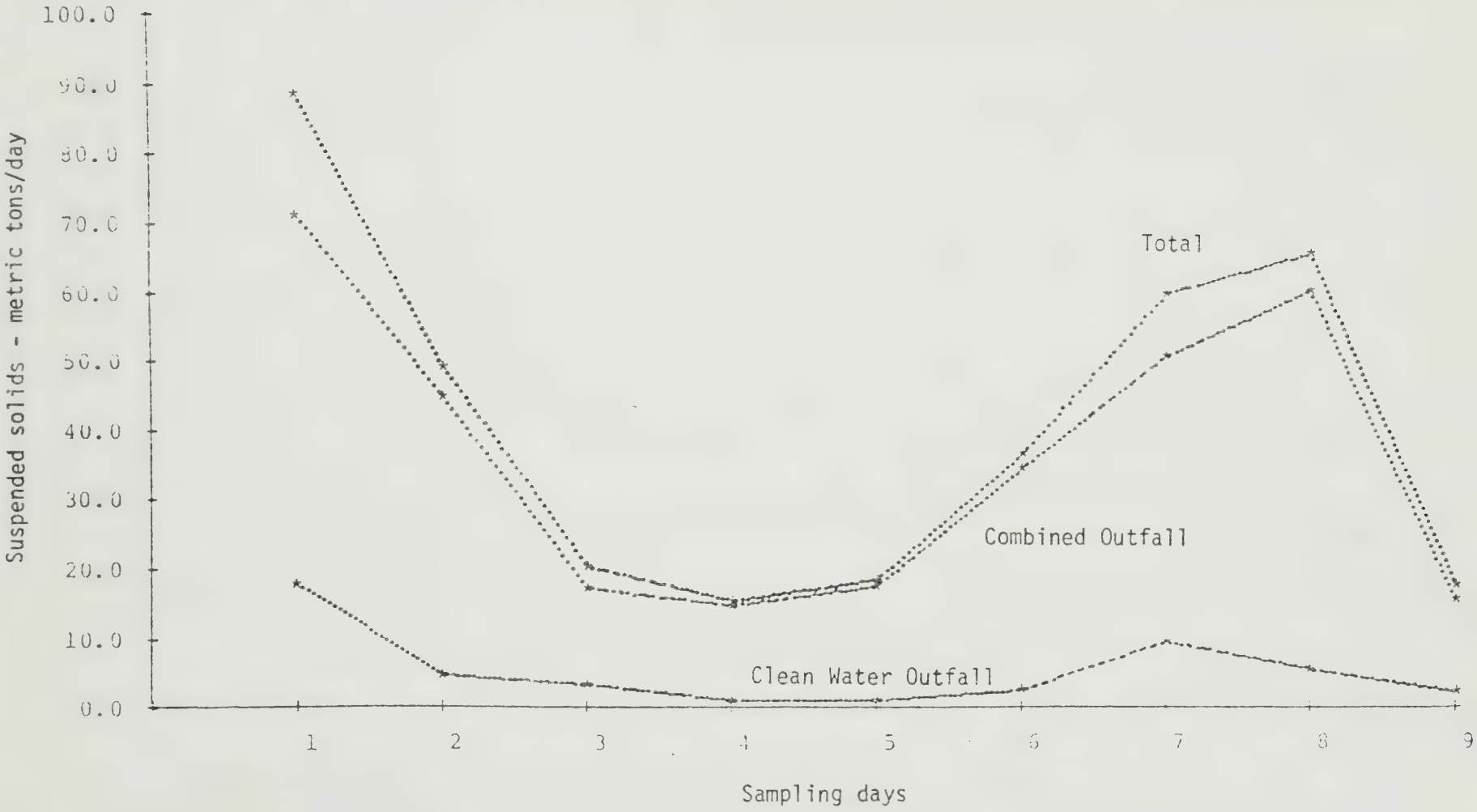


FIGURE 5. Suspended solids loading to Kaministiquia River.

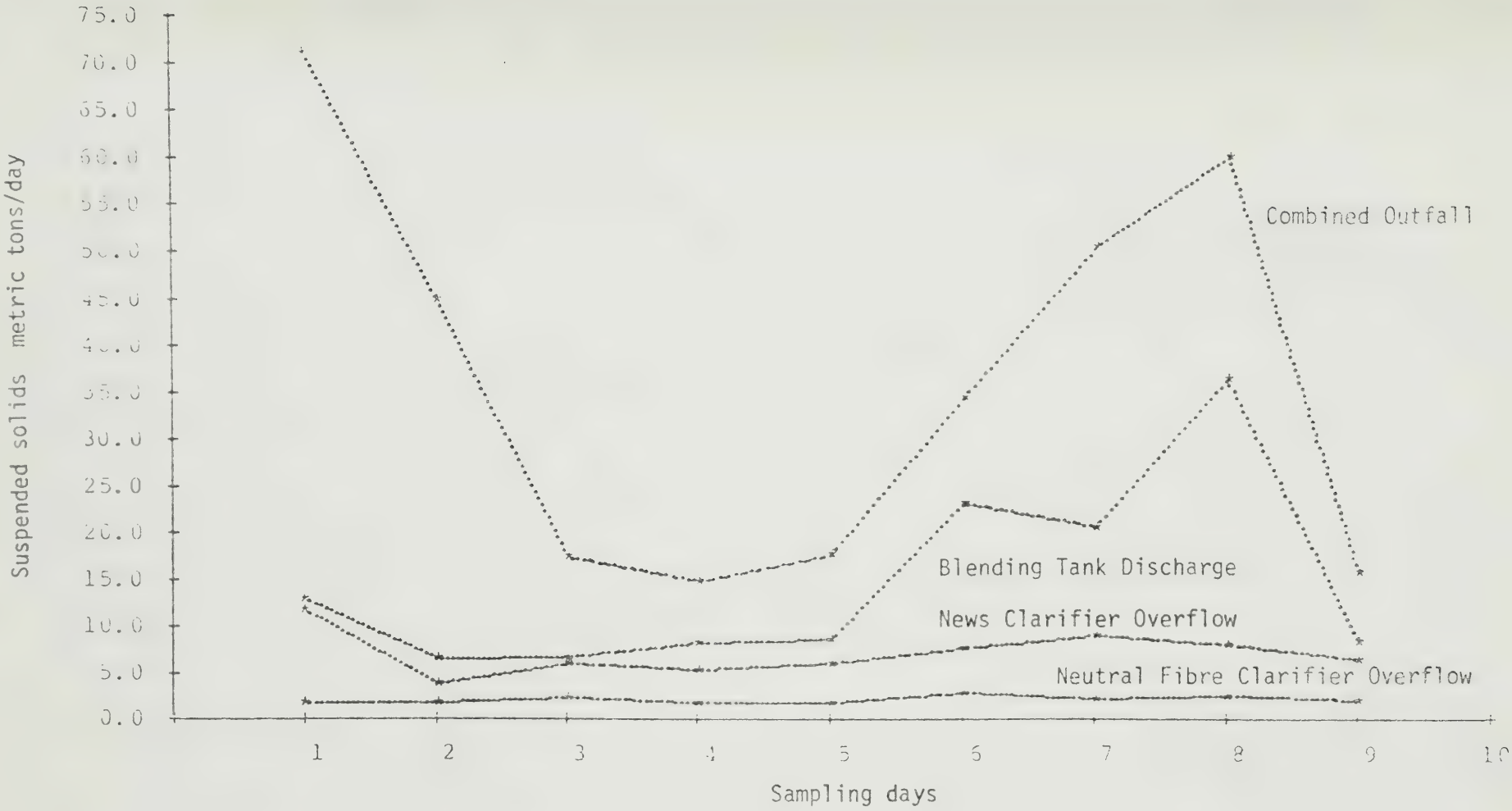


FIGURE 6. Suspended solids discharged from major sewers in the complex.

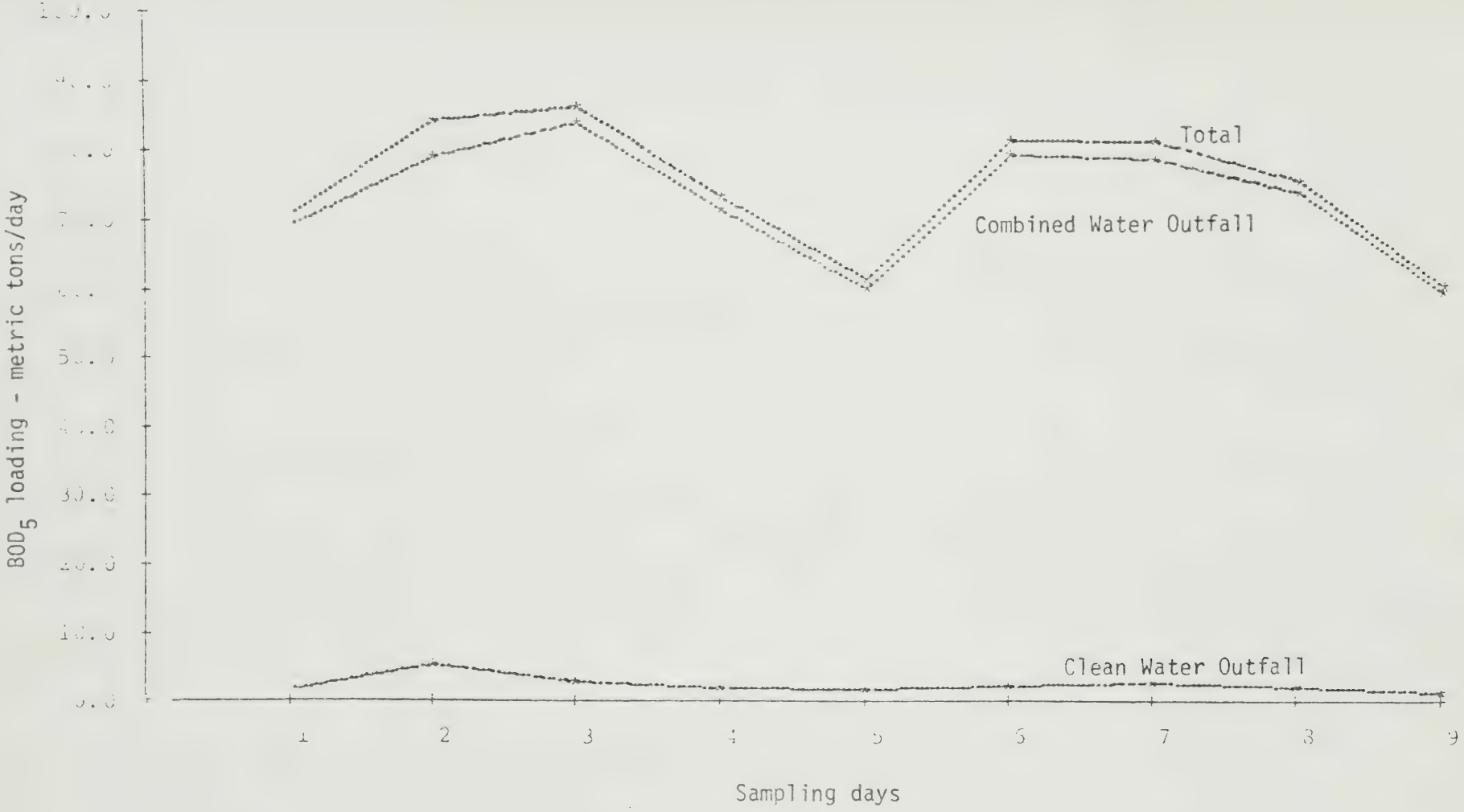


FIGURE 7. BOD_5 loadings to Kaministiquia River.

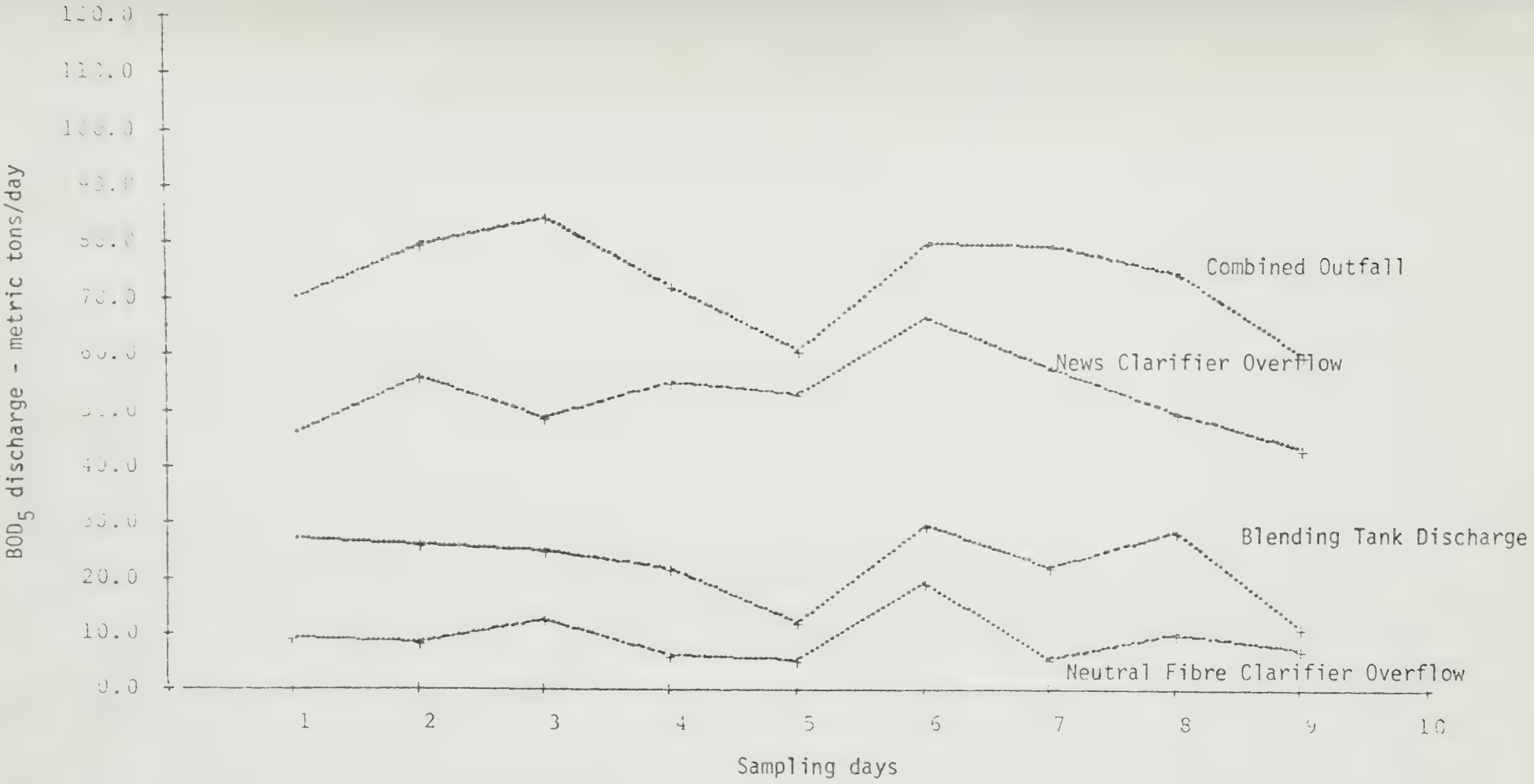


FIGURE 8. BOD_5 discharged from major sewers in the mill.

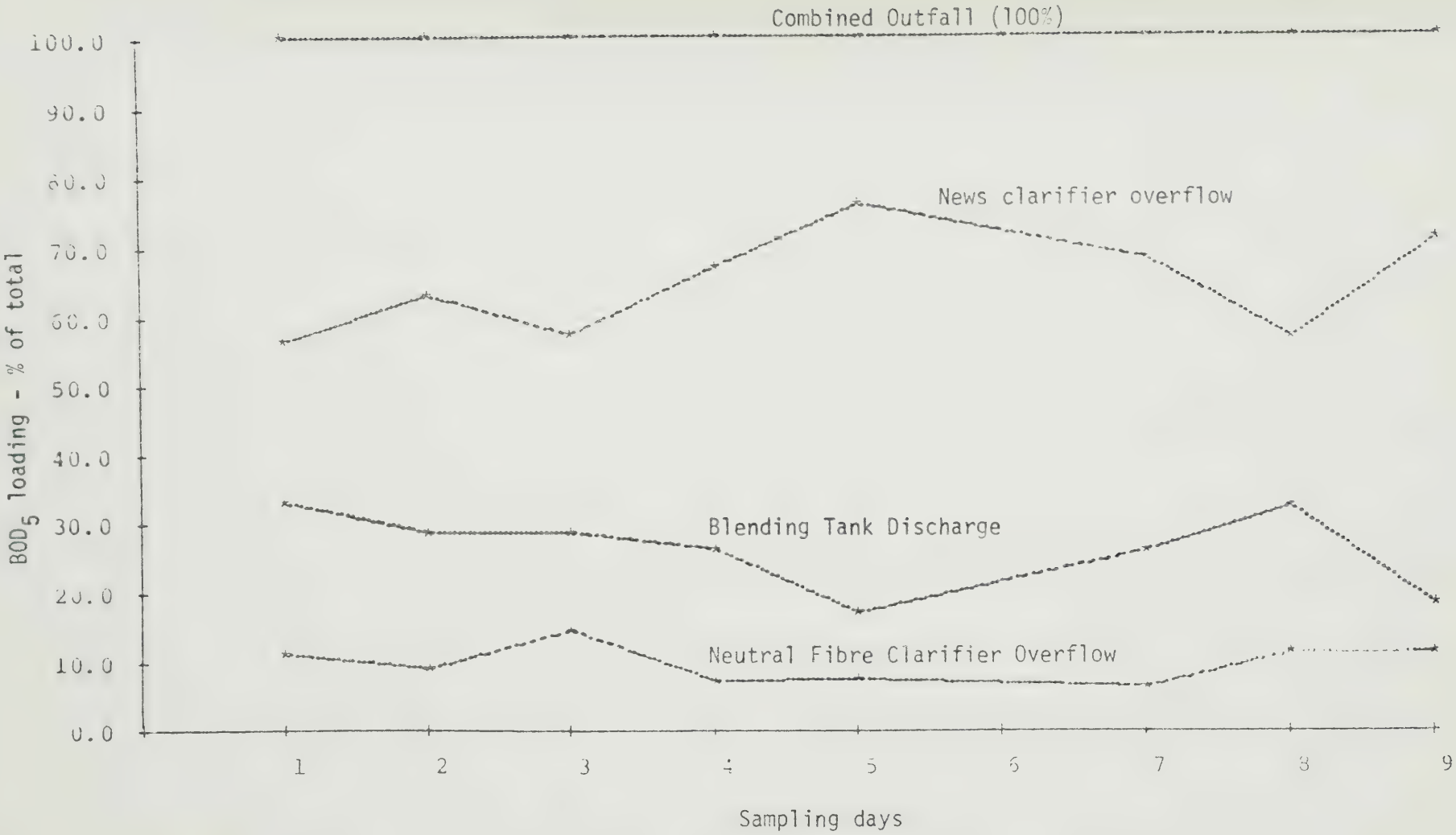


FIGURE 9. Percent contribution of major sewers to final effluent BOD_5 loadings.

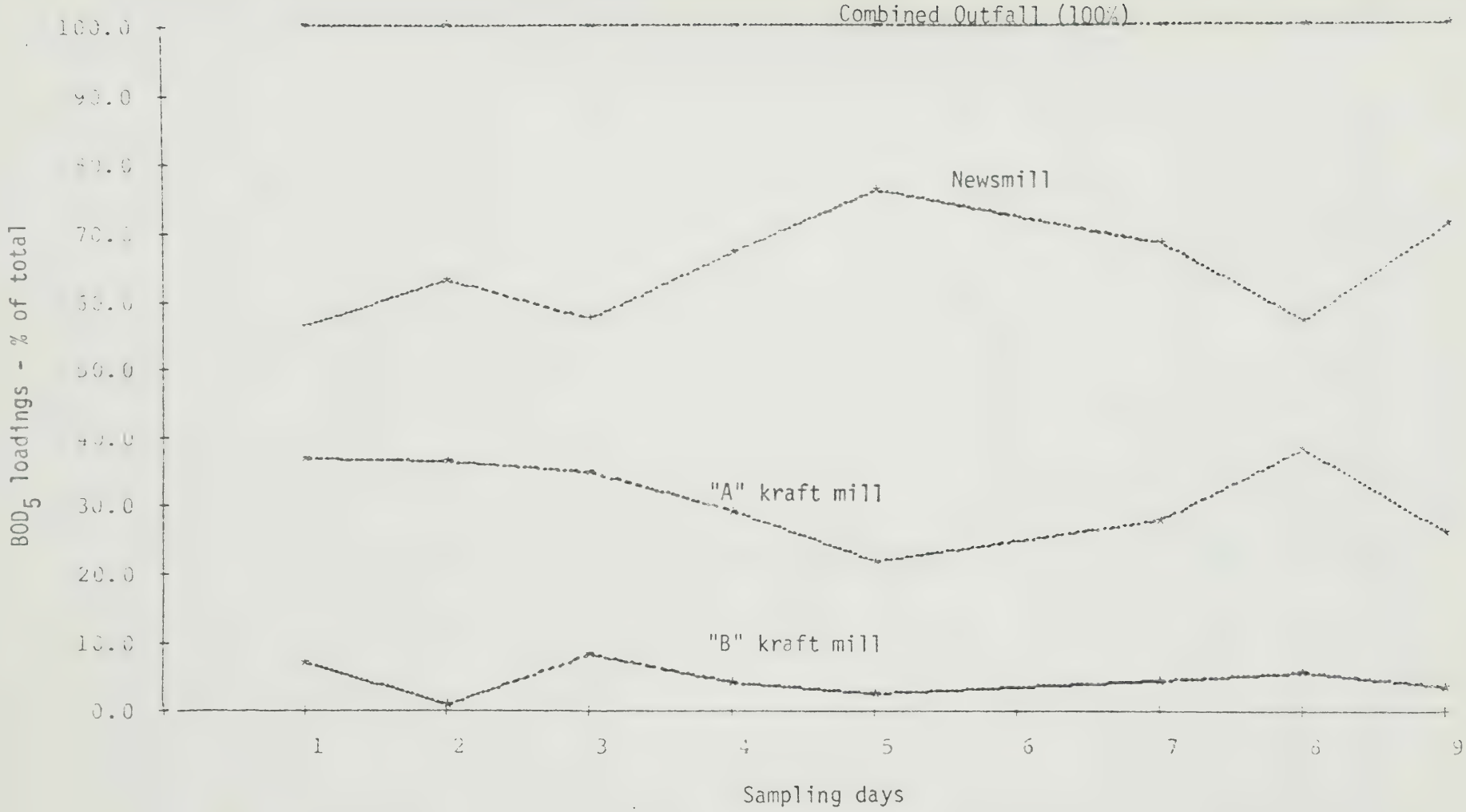


FIGURE 10. Percent contribution of various sections of the industrial complex to final effluent BOD_5 loading.

TABLE 1. Air emission source inventory at Great Lakes Forest Products Limited (based on design data).

Emission Source	NO_x g/sec	SO_2 g/sec	Particulate g/sec	Total Reduced Sulphur as H_2S g/sec
#1 kraft mill lime kiln	-	-	1.08	0.491
#2 kraft mill lime kiln	3.53	-	2.16	0.424
SBL oxidation	-	-	-	0.035
#1 kraft mill brown stock washers vent	-	-	-	0.323
#2 kraft mill diffusion washer sealtank vent		NEGLIGIBLE		
Turpentine decanter vent		NEGLIGIBLE		
Weak black liquor oxidation vent				
#1 kraft mill		NEGLIGIBLE		
#2 kraft mill		NEGLIGIBLE		
#1 kraft mill foam beaters vent		NEGLIGIBLE		
#1 kraft mill blow tank vent		NEGLIGIBLE		
#2 kraft mill lime slaker		NEGLIGIBLE		
Steam plant	-	-	593.01	-
Sulphite mill blow stack		NOT AVAILABLE		
Sulphite mill TCA tower vent		7.23		
Copeland		1.47	0.378	
#2 kraft mill bleach plant vents	-	-	-	-
#1 kraft mill bleach plant vents	-	-	-	-
#2 kraft mill foam tank	-	NEGLIGIBLE		-
#2 kraft mill W.B.L. oxidation towers	-	-	-	0.33
#1 kraft mill W.B.L. oxidation towers (East and West)	-	-	-	0.33
Tall oil plant vent				0.076
#1 recovery boiler	-	-	22.57	1.67
#2 recover boiler	-	-	15.75	0.56
#6 power boiler	92.2	13.86	13.48	-

TABLE 2. Complaints from the residents in the vicinity of Great Lakes Forest Products Limited.

Date	Nature of Complaint
Dec. 31/74	Odour
Dec. 31/74	Odour
July 18/75	Odour
Nov. 25/75	Odour
Apr. 28/76	Odour (Bleach Plant)
Aug. 25/76	Odour and smog
Sep. 3/76	Sawdust
Sep. 3/76	Sawdust
Feb. 10/77	Sulphur dioxide smell
Feb. 16/77	Sulphur dioxide smell
Apr. 4/77	Black smoke from recovery stack
Oct. 6/77	Lime dust and black liquor
Oct. 17/77	Dust on cars
Oct. 21/77	White dust and black smoke
Nov. 14/77	Black particulate and black smoke
Nov. 14/77	black particulate
Nov. 15/77	Black particulate
Nov. 28/78	Kraft mill odour
Mar. 28/78	Odour
Mar. 29/78	Smog in the air
Mar. 31/78	Smog in the air
May 17/78	Odour from the mill
May 31/78	Salt cake on cars
Jun 28/78	Lignin odours
Jul. 25/78	Odour (choking)
Jul. 27/78	Odour
Nov. 2/78	White particulate and odour
Nov. 2/78	Odour
Nov. 8/78	Odour (burns eyes)
Nov. 20/78	Odour

TABLE 2 (Continued)

Date	Nature of Complaint
Dec. 1/78	Odour
Jan. 25/79	Odour
Jan. 31/79	Odour
Feb. 1/79	Odour
Feb. 19/79	Odour
Mar. 2/79	Odour
Mar. 12/79	Odour
Mar. 21/79	Odour
Apr. 2/79	Odour
Apr. 9/79	Odour (wood burning)
May 14/79	Odour
May 25/79	Odour
May 29/79	Odour
Jun. 28/79	Odour
Jul. 6/79	Odour
Jul. 6/79	Odour
Jul. 7/79	Odour
Jul. 8/79	Odour
Jul. 14/79	Odour
Jul. 15/79	Odour
Jul. 20/79	Odour
Nov. 19/79	Odour

TABLE 3: Calculation of Suspended Solids Discharged from Blending Tank based upon Monthly Report Figures

MONTH (1978)	News Clarifier out - t/d* A	N.F. Clarifier out - t/d B	Total out - t/d C = A + B	Combined Outfall t/d D	Blending** tk out t/d E = D - C	Flow From Blend tk. m^3/d F	S.S. Discharge** From Blend tk. ppm E/F
Apr	5.67	2.62	8.29	28.6	20.3	41,000	495
May	4.88	1.20	6.08	20.1	14.02	42,000	334
Jun	5.51	1.20	6.71	24.6	17.9	38,000	426
Jul	6.93	1.50	8.43	21.2	12.8	52,000	246
Aug	5.00	1.2	6.2	29.1	22.9	53,000	432
Sep	5.87	1.86	7.73	30.3	22.6	49,000	460
Oct	5.70	1.45	7.15	20.6	13.4	49,000	274
Nov	5.41	1.45	6.86	18.0	11.1	47,000	237
Dec	4.70	1.45	6.15	17.4	11.2	49,000	230

* t/d = Tonnes/day

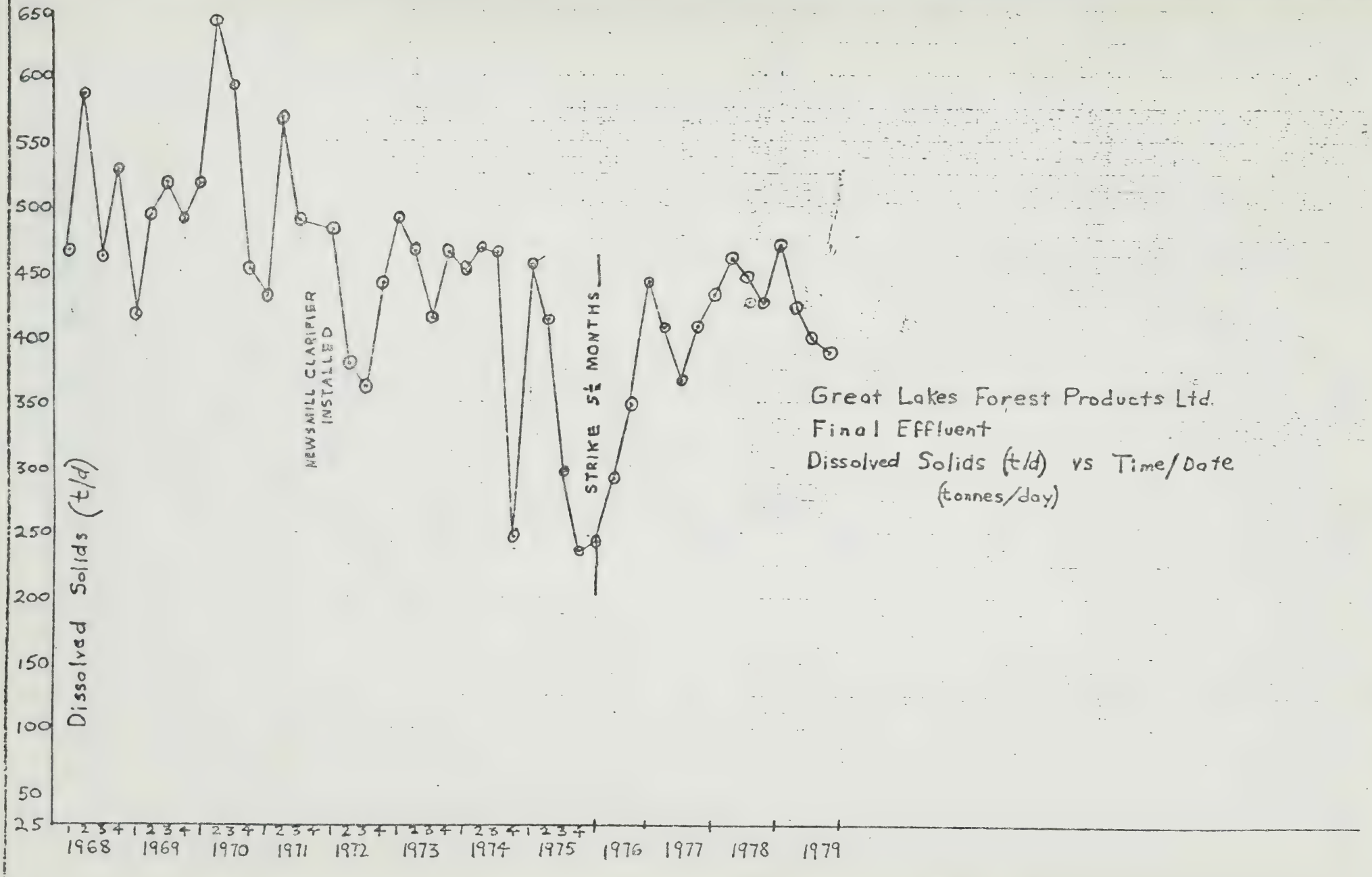
** These columns contain S.S. discharged from the blending tank and other relatively minor sources.

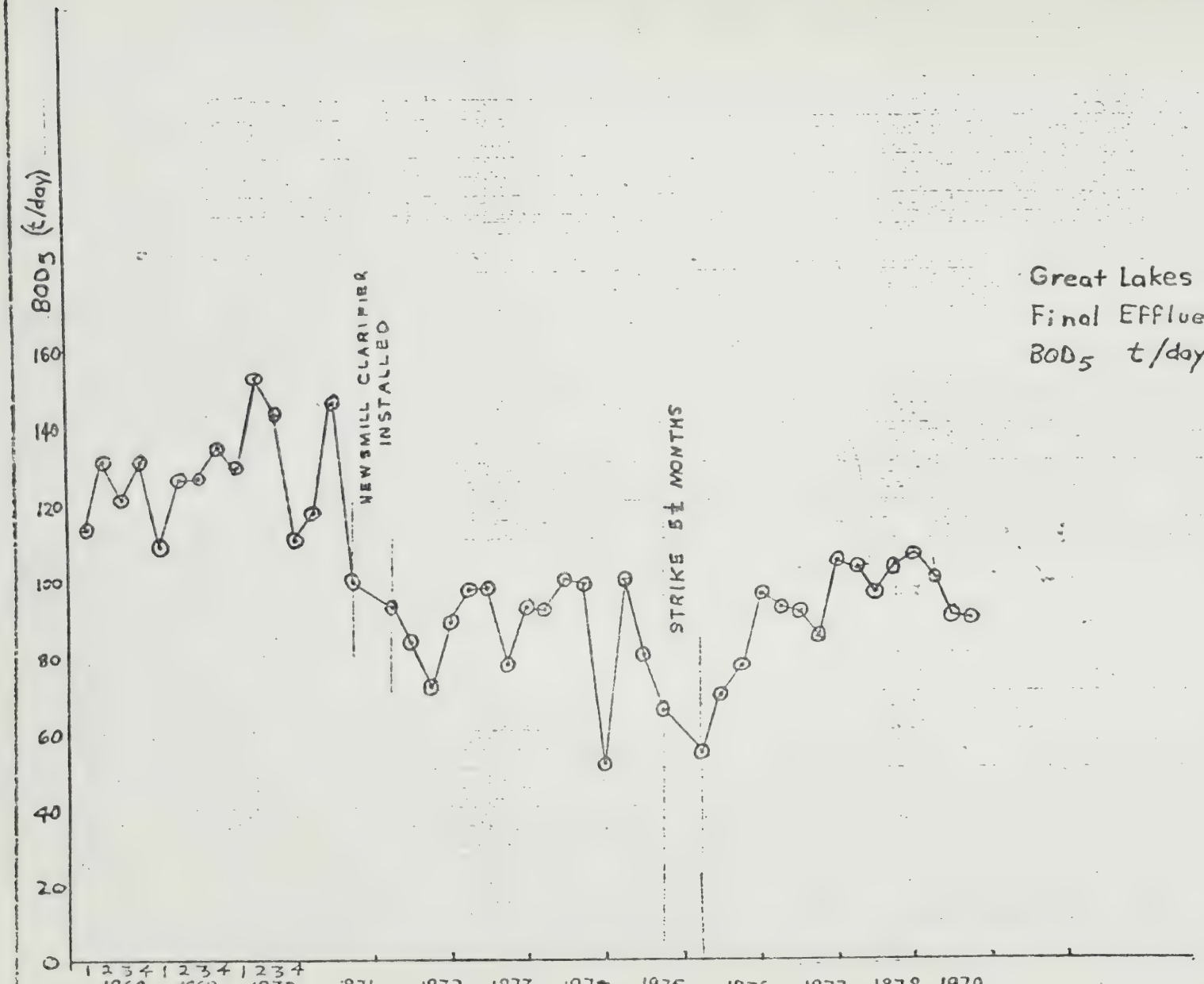
APPENDIX A

INFORMATION SUPPLIED BY THE COMPANY

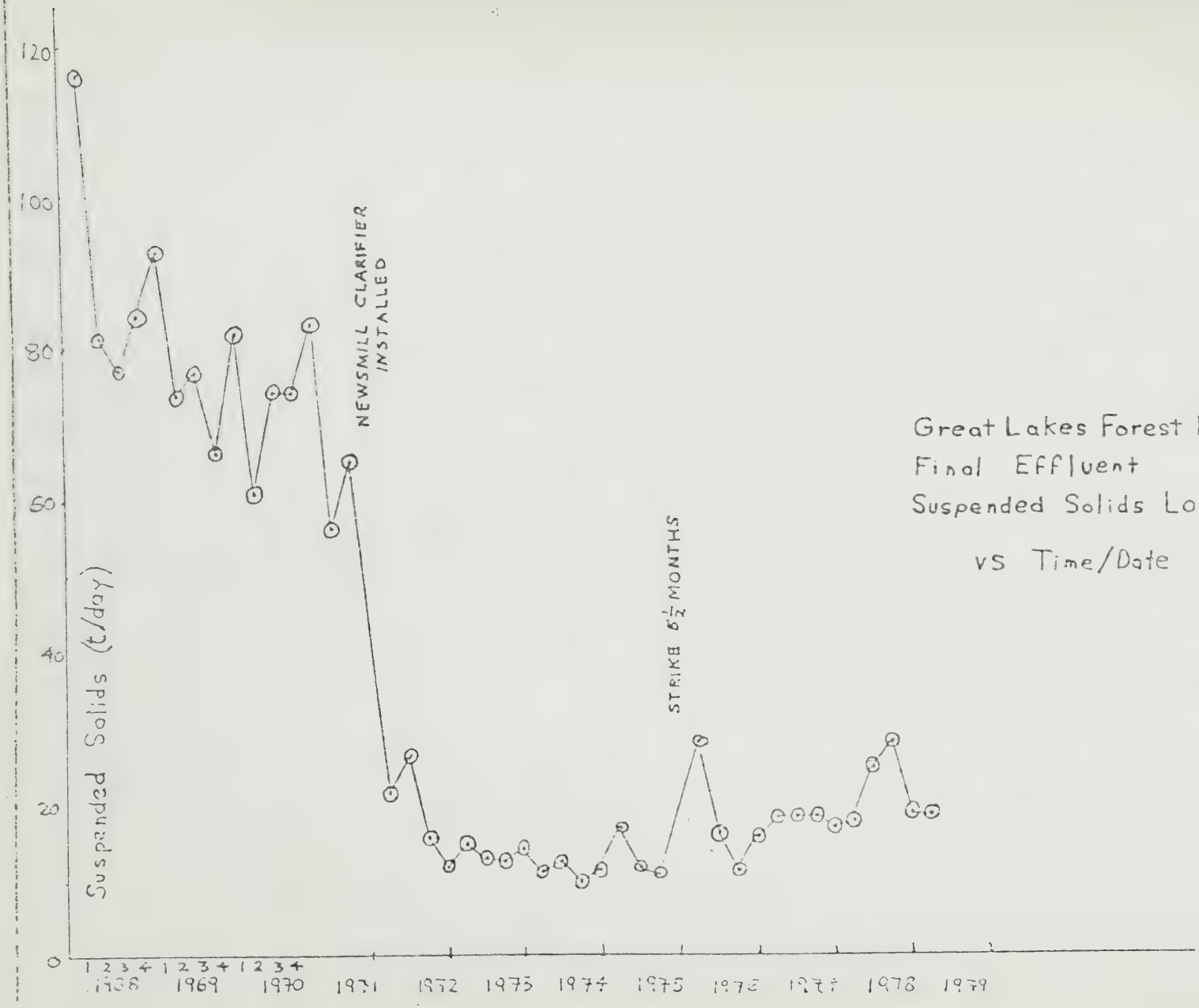
IN ITS QUARTERLY OR MONTHLY REPORT

SINCE 1968


Dissolved Solids (t/d)
650
600
550
500
450
400
350
300
250
200
150
100
50
25
NEWSMILL CLARIFIER INSTALLED
STRIKE 5½ MONTHS
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979
Great Lakes Forest Products Ltd.
Final Effluent
Dissolved Solids (t/d) vs Time/Date
(tonnes/day)

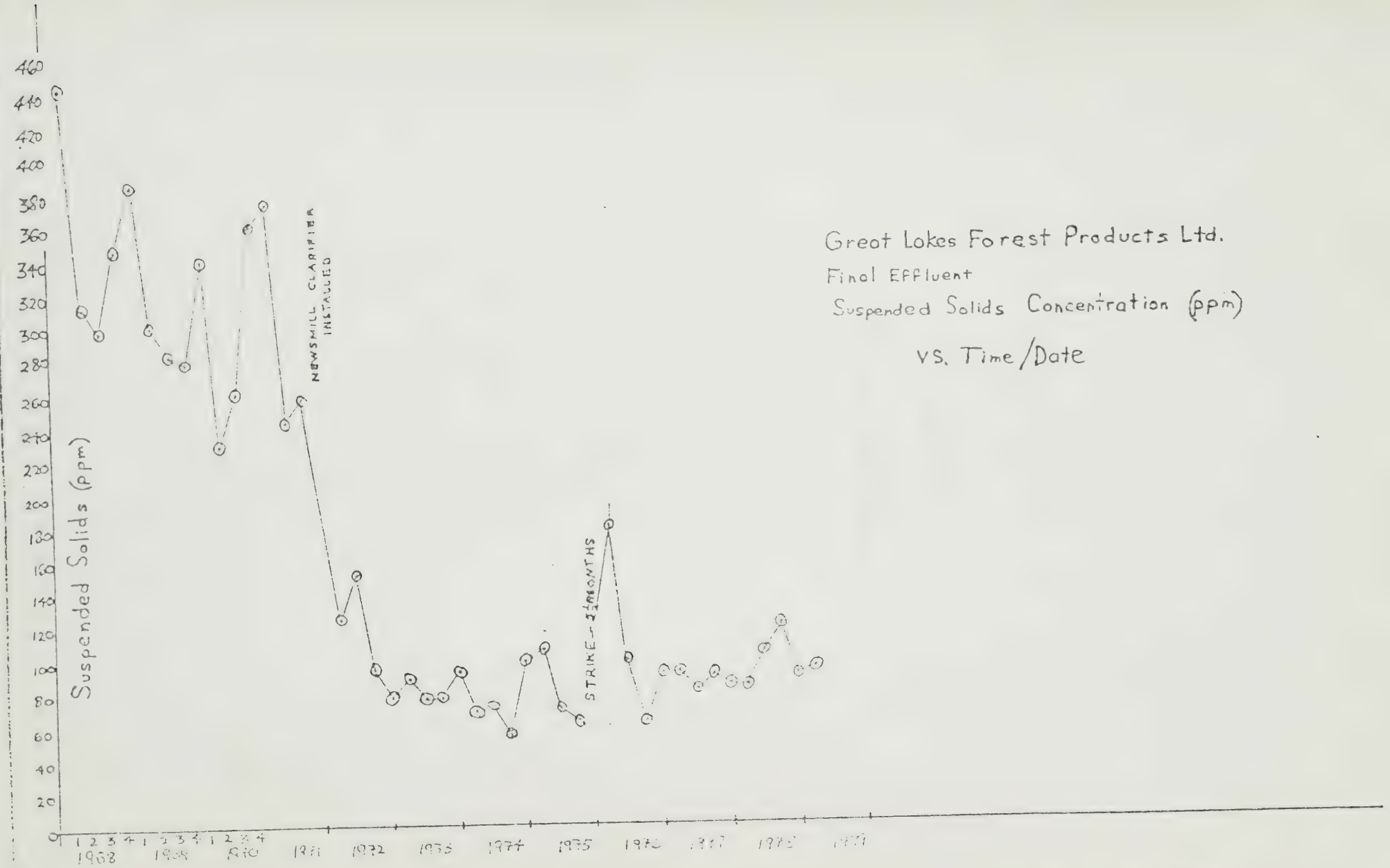


Great Lakes Forest Products Ltd.
Final Effluent
BOD_5 t/day vs Time/Date



Great Lakes Forest Products Ltd.
Final Effluent
Suspended Solids Load (tonnes/day)

vs Time/Date


Great Lakes Forest Products Ltd.
Final Effluent
Suspended Solids Concentration (ppm)
vs. Time/Date
Suspended Solids (ppm)
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
NEWSMILL CLARIFIER INSTALLED
STRIKE - 2½ MONTHS
1 2 3 4 1 2 3 4 1 2 3 4
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979

STATION 1: Clean Water Outfall

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	20	70	36	19	18	24	25	17	11
Total Solids	690	--	--	--	--	--	590	--	510
Sus. Solids	230	60	45	10	10	25	95	55	20
Dis. Solids	460	800	465	680	500	1475	495	415	490
Kjeldahl N	--	--	--	--	1.3	1.3	1.1	1.2	1.4
Phosphorus	.27	.11	.16	.050	.080	.070	.11	.040	.030
SO_4	29	252	46	315	132	424	135	61	190
Phenols (ppb)	10	75	25	21	24	75	30	31	33
pH	7.4	3.4	10.7	9.5	8.9	9.1	8.3	9.1	7.5
Volatile Total Solids									
Dried	690	860	45	690	510	1500	590	470	510
Ashed	620	730	25	620	440	1370	490	400	460
Loss	70	130	20	70	70	130	100	70	50
COD	--	--	--	225	100	125	150	150	50
Flow (USGPM)	14000	13500	12750	15800	15400	15400	17400	17400	17900

NOTE: All values in ppm except Phenols and pH.

STATION 2: Combined Water Outfall

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	390	410	450	400	330	420	440	420	350
Total Solids	2770	--	--	--	--	--	2720	--	2550
Sus. Solids	400	230	90	80	95	180	280	340	90
Dis. Solids	2370	800	2650	2280	2035	2680	2440	2740	2460
Kjeldahl N	--	--	--	--	2.3	2.4	3.2	2.6	2.0
Phosphorus	.77	.80	.96	.56	.59	.84	.81	.76	.53
SO_4	174	252	46	103	90	113	144	137	143
Phenols	200	100	200	257	332	407	172	524	305
pH	6.6	6.4	5.9	6.9	7.1	7.2	7.0	7.8	7.0
Volatile Total Solids									
Dried	2770	860	90	2360	2130	2860	2720	3080	2550
Ashed	1470	730	30	1210	1080	1590	1420	1770	1190
Loss	1300	130	60	1150	1050	270	1300	1310	1360
COD	--	--	--	1900	--	125	1975	2200	2000
Flow (USGPM)	32446	35272	34025	32578	33062	34430	32600	32000	30625

NOTE: All values in ppm except Phenols and pH.

STATION 3: Neutral Fibre Clarifier - In

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	370	250	430	230	160	540	140	300	170
Total Solids	1690	--	--	--	--	--	990	--	1260
Sus. Solids	130	110	560	130	190	160	400	320	90
Dis. Solids	1560	1170	2080	1060	790	2400	590	1510	1170
Kjeldahl N	--	--	--	--	1.3	1.9	1.2	2.2	1.4
Phosphorus	.39	.34	1.5	.40	.42	.73	.53	.49	.31
SO_4	73	101	68	44	39	88	68	63	35
Phenols	500	275	625	380	300	804	276	686	553
pH	10.8	10.6	10.7	10.2	9.7	11.0	9.7	10.3	9.6
Volatile Total Solids									
Dried	1690	1280	560	1190	980	2560	990	1830	1260
Ashed	770	710	140	620	500	1580	390	990	610
Loss	920	570	420	570	480	980	600	840	650
COD	--	--	--	1075	100	125	900	1550	1125
Flow (USGPM)	4000	4700	4900	4900	4925	5475	5100	4975	4875

NOTE: All values in ppm except Phenols and pH.

STATION 4: News Clarifier - In

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	400	470	520	400	460	440	600	360	400
Total Solids	2800	--	--	--	--	--	3260	--	2480
Sus. Solids	560	630	590	440	440	580	600	390	490
Dis. Solids	2240	2190	2140	1860	2110	2110	2660	1750	1990
Kjeldahl N	--	--	--	--	2.2	2.3	2.6	2.4	3.0
Phosphorus	.83	1.1	.73	.96	.80	.91	1.0	.65	.65
SO_4	246	278	97	151	75	131	187	160	176
Phenols	80	125	250	48	75	80	100	172	95
pH	5.9	6.6	4.5	6.4	5.6	5.9	6.0	6.2	5.7
Volatile Total Solids									
Dried	2800	2820	590	2300	2550	2690	3260	2140	2480
Ashed	990	1130	100	1000	920	1040	1540	730	760
Loss	1810	1690	490	1300	1630	1650	1720	1410	1720
COD	--	--	--	2250	2800	2575	3550	2000	24750
Flow (USGPM)	18696	20292	18620	19878	20207	20050	19250	18500	18000

NOTE: All values in ppm except Phenols and pH.

STATION 5: Neutral Fibre Clarifier - Out

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	400	300	450	210	180	620	180	350	250
Total Solids	1730	--	--	--	--	--	900	--	1460
Sus. Solids	65	55	75	55	55	85	60	80	60
Dis. Solids	1665	1375	2585	925	855	2815	840	2050	1400
Kjeldahl N	--	--	--	--	1.6	2.9	.90	1.8	1.7
Phosphorus	.43	.41	1.4	.4	.41	.95	.42	.62	.43
SO_4	80	92	80	45	37	101	.76	79	44
Phenols	555	250	575	375	407	750	376	820	676
pH	10.6	10.6	10.1	10.1	9.9	10.9	9.8	10.5	9.9
Volatile Total Solids									
Dried	1730	1430	75	980	910	2900	900	2130	1460
Ashed	970	800	15	560	500	1810	460	1420	720
Loss	760	630	60	420	410	1090	440	710	740
COD	--	--	--	975	--	2750	700	1750	1225
Flow (USGPM)	4000	49000	4900	4900	4925	5475	5160	4975	4875

NOTE: All values in ppm except Phenols and pH.

STATION 6: Blending Tank - Out

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	500	450	420	500	270	600	490	610	260
Total Solids	4280	--	--	--	--	--	5230	--	4610
Sus. Solids	240	110	110	190	190	470	460	790	190
Dis. Solids	4040	5070	4480	4740	2970	4630	4770	6090	4420
Kjeldahl N	--	--	--	--	3.9	4.3	3.0	2.7	2.1
Phosphorus	1.48	1.38	1.5	1.1	.70	1.5	1.3	1.6	1.0
SO_4	115	177	123	60	30	103	136	173	126
Phenols (ppb)	300	175	175	402	429	456	286	1239	143
pH	6.7	6.4	5.7	7.9	7.5	7.4	7.4	8.8	7.5
Volatile Total Solids									
Dried	4280	5180	110	4930	3160	5100	5230	6880	4610
Ashed	2890	3620	55	3530	2410	3590	3750	5540	3450
Loss	1390	1560	55	1400	750	1510	1480	1340	1160
COD	--	--	--	2475	1250	2525	2550	3600	2000
Flow (USGPM)	9600	10200	10460	7700	7850	8825	8000	8275	7506

NOTE: All values in ppm except Phenols and pH.

STATION 7: News Clarifier - Out

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	440	500	470	500	470	600	540	480	430
Total Solids	2180	--	--	--	--	--	2440	--	2380
Sus. Solids	110	30	55	45	50	65	80	75	60
Dis. Solids	2070	2210	2025	2045	1170	2345	2360	2095	2320
Kjeldahl N	--	--	--	--	2.0	2.2	2.0	1.9	2.3
Phosphorus	.51	.51	.56	.42	.56	.72	.59	.49	.43
SO_4	275	306	218	214	131	197	231	162	220
Phenols	60	125	95	54	80	80	67	67	71
pH	4.9	5.6	4.7	4.4	4.7	5.6	5.9	6.1	5.6
Volatile Total Solids									
Dried	2180	2240	55	2090	2220	2410	2440	2170	2380
Ashed	780	790	15	920	630	1200	1170	810	760
Loss	1400	1550	40	1170	1590	1210	1270	1360	1620
COD	--	--	--	2250	2325	2475	2500	2150	2525
Flow (USGPM)	18696	20292	18620	19878	20207	20050	19250	18500	18000

NOTE: All values in ppm except Phenols and pH.

STATION 8: "B" Kraft Mill Neutral Fibre

Parameter	May 30/78	May 31/78	Jun 1/78	Jun 20/78	Jun 21/78	Jun 22/78	Jun 27/78	Jun 28/78	Jun 29/78
BOD_5	480	74	620	250	140	1040	270	370	170
Total Solids	3470	--	--	--	--	--	580	--	1530
Sus. Solids	320	55	60	85	30	150	45	570	65
Dis. Solids	3150	475	4290	1645	1250	4580	535	2420	1465
Kjeldahl N	--	--	--	--	.40	2.1	.30	1.0	1.3
Phosphorus	.36	.22	2.1	.46	.57	1.2	.14	.58	.29
SO_4	1229	74	112	52	50	129	77	92	76
Phenols	650	8	275	112	64	777	15	429	38
pH	11.2	7.0	9.6	9.7	7.9	11.3	9.6	11.0	9.1
Volatile Total Solids									
Dried	3470	530	60	1730	1280	4730	580	2990	1530
Ashed	2150	360	15	1190	870	2940	380	1640	880
Loss	1320	170	45	540	410	1790	200	1350	600
COD	--	--	--	1225	2325	2475	350	2425	975
Flow (USGPM)	2100	1800	2000	2300	2100	2400	2400	2200	2100

NOTE: All values in ppm except Phenols and pH.

APPENDIX C

DATA COLLECTED

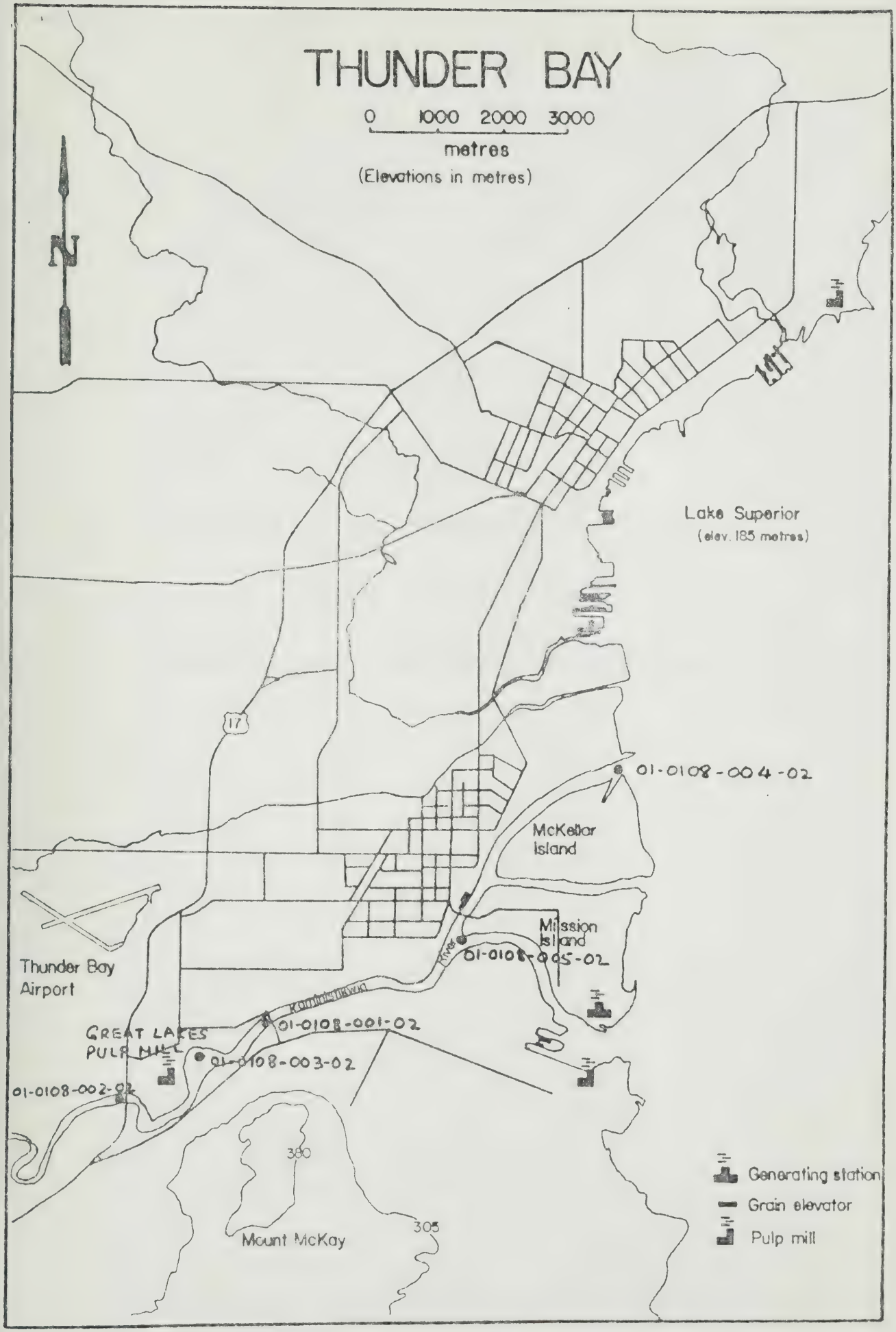
ON THE WATER QUALITY OF

THE KAMINISTIQUIA RIVER

APPENDIX C. Data on water quality of Kaministiquia River.

Year	Station Number	Station Location	Annual Average BOD_5 (mg/l)	Annual Average D.O.* (mg/l)
1979	01-0108-001-02	Kaministiquia River at Highway #61B at Swing Bridge	11.80	10.40
1979	01-0108-002-02	Kaministiquia River at Highway #61	1.30	11.50
1979	01-0108-003-02	Kaministiquia River at turning basin	11.40	9.30
1979	01-0108-004-02	Kaministiquia River near mouth	2.89	8.90
1979	01-0108-005-02	Kaministiquia River at Mission River Junction	11.80	8.50
1978	01-0108-001-02	Kaministiquia River at Highway #61B at Swing Bridge	12.60	11.00
1978	01-0108-002-02	Kaministiquia River at Highway #61	1.50	11.40
1978	01-0108-003-02	Kaministiquia River at turning basin	11.90	8.70
1978	01-0108-004-02	Kaministiquia River near mouth	4.10	7.00
1978	01-0108-005-02	Kaministiquia River at Mission River Junction	11.20	9.30
1977	01-0108-001-02	Kaministiquia River at Highway #61B at Swing Bridge	20.70	8.00
1977	01-0108-002-02	Kaministiquia River at Highway #61	2.30	10.40
1977	01-0108-003-02	Kaministiquia River at turning basin	25.80	6.40
1977	01-0108-004-02	Kaministiquia River near mouth	NO DATA**	NO DATA**
1977	01-0108-005-02	Kaministiquia River at Mission River Junction	16.10	7.70

*Dissolved Oxygen
**Station started in 1978.



LOCATION OF SAMPLING STATIONS ON KAMINISTIQUIA RIVER

APPENDIX D

CALCULATION OF

ALLOWABLE BOD AND SUSPENDED SOLIDS DISCHARGES

FROM THE INDUSTRIAL COMPLEX

BASED ON FEDERAL AND PROVINCIAL REQUIREMENTS

GREAT LAKES FOREST PRODUCTS LTD. - THUNDER BAY

CALCULATION OF FEDERAL EFFLUENT REQUIREMENTS

BASIS PRODUCTION (1978): 882 ADT groundwood pulp
168 ADT Na base sulphite pulp
1119 ADT kraft pulp - bleached and semi-bleached

PRODUCT MIX: 1136 ADT newsprint
1033 ADT kraft pulp

ASSUMPTIONS: 1 ADT = 0.9 ODT

kraft pulp yield = 57% unbleached
49% bleached

newsprint furnish = 882 ADT groundwood
168 sulphite
86 kraft

sulphite yield = 75%
groundwood yield = 96%

(1) SUSPENDED SOLIDS

(a) wood usage: kraft: $1119 \times \frac{57}{49} \times \frac{100}{57} \times 0.9$ = 2,055

sulphite: $168 \times \frac{100}{75} \times 0.9$ = 202

groundwood: $882 \times \frac{100}{96} \times 0.9$ = 827

∴ woodroom allowance 3084 x 10 = 30,840

(b) kraft pulping $1119 \times \frac{57}{49} \times 7$ = 9,112

(c) kraft bleaching 1119 x 6 = 6,714

(d) kraft sheet formation 1033 x 2 = 2,066

(e) sulphite pulping 168 x 7 = 1,176

(f) groundwood pulping 882 x 13 = 11,466

(g) groundwoos brightening 882 x 2 = 1,764

(h) newsprint - kraft: 86 x 3
- sulphite: 168 x 3
- groundwood: 882 x 5 = 5,172

TOTAL 68,310

TOTAL MILL SOLIDS 68,310 lbs/day or 31.0 metric tons/day

(2) BOD_5

(a) wood preparation 3084 x 7	= 21,588
(b) kraft pulping 1119 x $\frac{57}{49}$ x 64	= 83,308
(c) kraft bleaching 1119 x 27	= 30,213
(d) sulphite pulping 168 x 255	= 42,840
(e) groundwood pulping 882 x 30	= 26,460
TOTAL	204,409

TOTAL BOD_5 204,409 lbs/day or 92.7 metric tons/day

GREAT LAKES FOREST PRODUCTS LIMITED

CALCULATION OF PROVINCIAL SUSPENDED SOLIDS ALLOWANCE

BASIS: Highest production rate averaged over a month (1976/79)

Saleable Kraft = 1168 tonnes/day = 1287 short tons/day

Saleable Newsprint = 1131 tonnes/day = 1247 short tons/day

Therefore, Newsprint production = 1247 short tons/day
Kraft Production = 1287 + (10% of 1247) = 1411.7 short tons/day

Water Allowance = $1247 \times 15{,}000 + 1411.7 \times 30{,}000$

$= 61.06 \times 10^6$ I.G./day

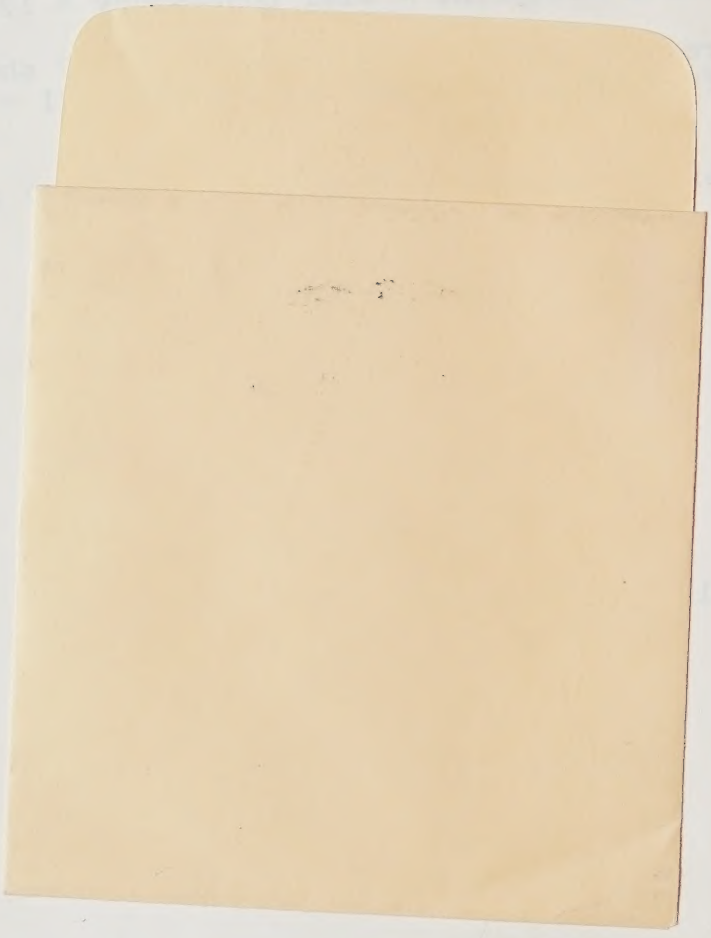
$= 610.6 \times 10^6$ lbs/day

S.S. Allowance = $610.6 \times 10^6 \times 50 \times 10^{-6}$

= 30,530 lbs/day

= 13.85 tonnes/day

say 14 metric tons of S.S./day




ACCO USA
WHEELING, ILLINOIS 60090
25979
MADE IN USA
0 50505 25979 3
EXECUTIVE RED/ROUGE EX/ROJO